UPPER SILURIAN CONODONTS FROM THE YARRANGOBILLY LIMESTONE, SOUTHEASTERN NEW SOUTH WALES

By Barry J. Cooper*

ABSTRACT: Conodonts from the Upper Silurian Yarrangobilly Limestone are described, using multielement taxonomy. The specimens are correlated with the *siluricus* and *crispa* Zones of Walliser (1964), which indicate a middle to late Ludlow age. It follows that the Yarrangobilly Limestone is equivalent to the Hume Limestone, Black Bog Shale and probably parts of the Rosebank Shale in the well-known Yass Basin succession.

INTRODUCTION

Yarrangobilly is situated about 65 km south of Tumut and 20 km north of Kiandra in south-eastern New South Wales. The area was first investigated geologically by Anderson (1886), who described the caves that had been discovered in the limestone. A geological map of the limestone was produced in a subsequent cave report by Trickett (1897). The entire Yarrangobilly area, including the limestone, was mapped by Adamson (1958) as part of the Snowy Mountains Hydroelectric Scheme.

Fossils were collected from the Yarrangobilly Limestone soon after a Caves Superintendent was appointed and were forwarded to the Geological Survey in Sydney. Etheridge (1893-4) and Andrews (1901) record the brachiopod, 'Pentamerus Knightii' as well as seven genera of gasteropods and bivalves from this collection. Rugose and tabulate corals have been described by Hill (1954) with revisions by Hamada (1957, 1958).

The present report considers a conodont collection from the Yarrangobilly Limestone which makes possible a correlation with other Silurian successions.

STRATIGRAPHY

In the Yarrangobilly area, Silurian sediments may be divided into two widespread stratigraphic units: the Tumut Ponds Group overlain by the Ravine Beds. This succession was first recognised near Kiandra (Moye, Sharp & Stapleton in Packham, 1969) and was extended into the Yarrangobilly area by Labutis (1969). The latter worker also demonstrated that the lenticular mass of the Yarrangobilly Limestone is equivalent to sediments close to the boundary of the Tumut Group and the Ravine Beds. The Goobarrangandra Porphyry, which outcrops just east of the Yarrangobilly Limestone, has been little studied. Adamson (1960) believes that it correlates with sediments within the Tumut Ponds Group. Strusz (1971) suggests that a fault separates the porphyry from the Silurian sediments.

PROCEDURE

Some 50 samples were collected for conodonts from two measured sections and several isolated localities in the Yarrangobilly Limestone. These are shown on the sketch map (Fig. 1) and the stratigraphic columns (Fig. 2) and described in the locality register at the end of the paper.

Approximately 1 kg of each sample was processed initially, using standard acetic acid techniques, and those samples yielding reasonable conodont abundances were subject to bulk recollection and further disaggregation. Overall, 120 kg of limestone were processed and about 800 identifiable conodonts were recovered. Table 1 summarises conodont occurrences in the Yarrangobilly Limestone. Barren samples are excluded.

BIOSTRATIGRAPHY

The establishment of a succession of conodont zones through most of the Silurian by Walliser (1964) permits ready age determination of the Yarrangobilly conodonts. Near the base of the Yarrangobilly Limestone, multielement species *Kockelella variabilis* and *Ozarkodina confluens* occur together. *K. variabilis* is restricted to the *crassa*, *ploeckensis* and *siluricus* Zones of Walliser, while *O. confluens* was not recorded below the *siluricus* Zone by Walliser. This suggests that the lower beds of the Yarrangobilly Limestone can be correlated best with the *siluricus* Zone even though the zonal name-giver is absent in the collections.

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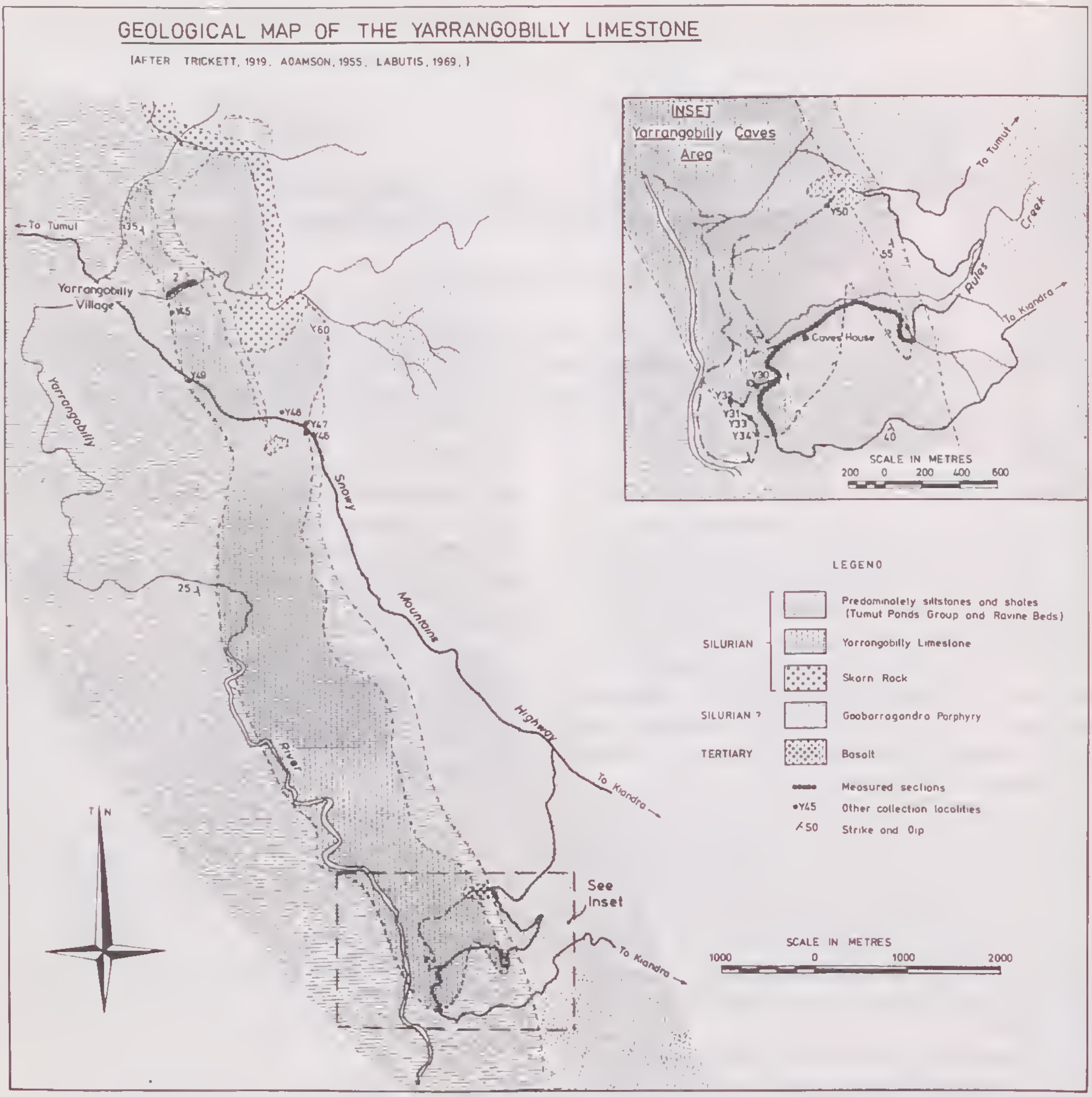

FIG. 1

The topmost beds of the Yarrangobilly Limestone contain the distinctive Pa skeletal component of the apparatus of *Ozarkodina crispa*. This is the index fossil for another of Walliser's (1964) zones, so a direct correlation can be made.

Hence the Yarrangobilly Limestone can be shown to correlate with the *siluricus* and *crispa* Zones of Walliser (1964), which suggests in terms of the presently recognised division of the Silurian (cf. Berry & Boucot, 1970, p. 9-19) a middle to late Ludlow age,

The recent study of conodonts from the classic Australian Silurian succession in the Yass Basin by Link (1970) and Link and Druce (1972) also allows a more accurate correlation than previously possible between the Yarrangobilly Limestone and the Yass succession. In the Yass Basin, the Hume Limestone and the base of the Black Bog Shale contains typical *siluricus* Zone conodonts that can be related to the conodont collection from near the base of the limestone at Yarrangobilly. The uppermost horizons of the Yarrangobilly Limestone are probably equivalent to beds within the Rosebank Shale in the Yass Basin. The failure of Link and Druce (1972) to find conodonts within this formation seems to account for the absence of *latialata* and *crispa* Zone conodonts at Yass in an otherwise complete succession of Walliser's (1964) late Silurian and early Devonian conodont zones.

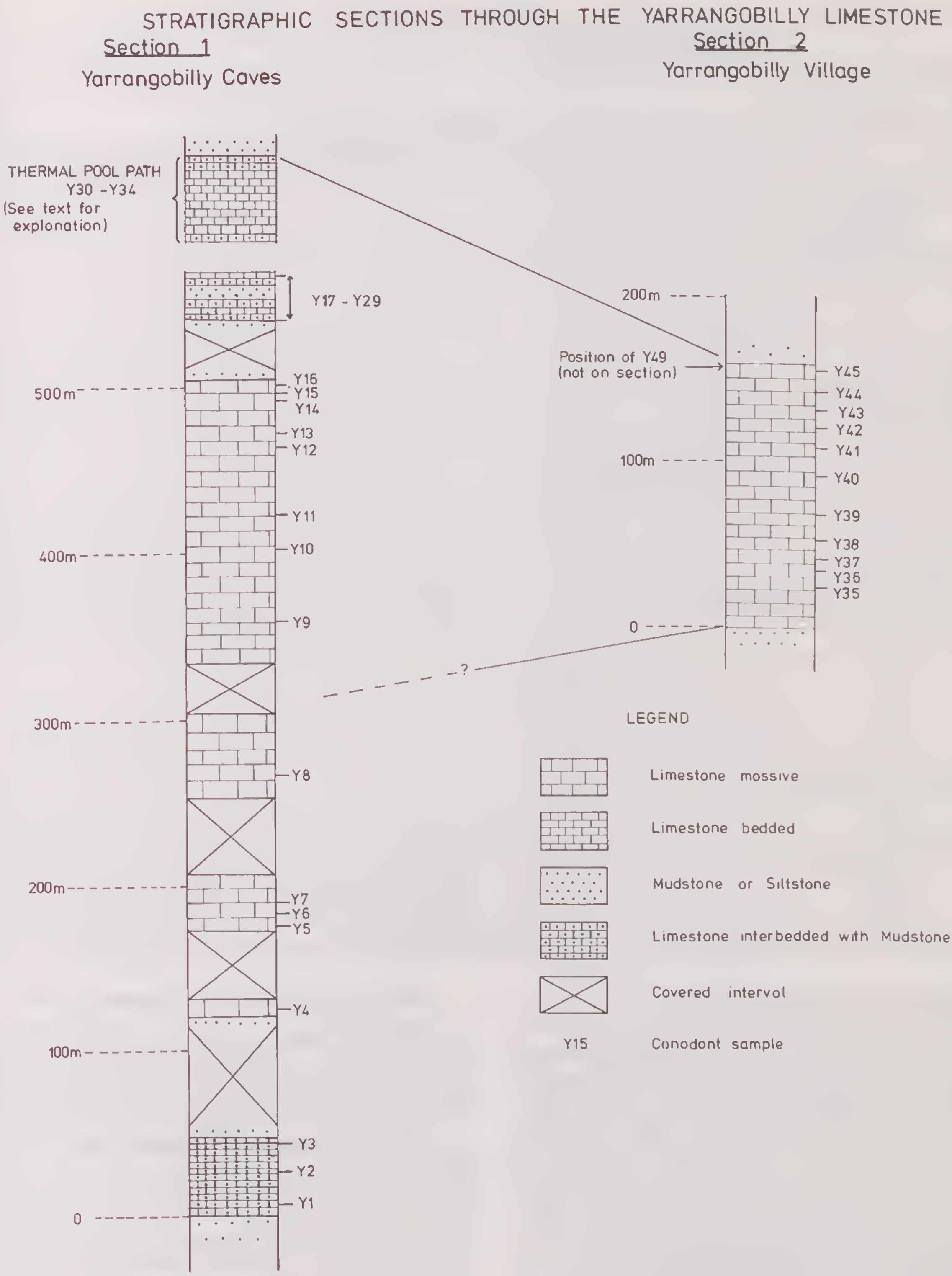
STRATIGRAPHIC SECTIONS THROUGH THE YARRANGOBILLY LIMESTONE
Section 1
Yarrangobilly Caves
Section 2
Yarrangobilly Village
THERMAL POOL PATH
Y30 -Y34
(See text for explonation)
Y17 - Y29
Y16
Y15
Y14
Y13
Y12
Y11
Y10
Y9
Y8
Y7
Y6
Y5
Y4
Y3
Y2
Y1
500m
400m
300m
200m
100m
0
200m
100m
0
Position of Y49 (not on section)
Y45
Y44
Y43
Y42
Y41
Y40
Y39
Y38
Y37
Y36
Y35
?
LEGEND
Limestone mossive
Limestone bedded
Mudstone or Siltstone
Limestone interbedded with Mudstone
Covered intervol
Y15
Conodont sample

FIG. 2

TABLE 1

DISTRIBUTION OF CONODONTS IN THE YARRANGOBILLY LIMESTONE

SPECIES	SAMPLE NUMBERS																								
	Y5	Y6	Y7	Y9	Y11	Y18	Y19	Y21	Y23	Y24	Y25	Y26	Y27	Y28	Y31	Y32	Y34	Y35	Y36	Y37	Y38	Y41	Y43	Y44	Y49	Y50
Belodella anomalis																										
lenticular																				r		r		r	r	
triangular							r			r						r	r					r	r	r	r	
Kockelella variabilis																										
Pa		r	r																							
Pb			c																							
Sa			r																							
Sb			r																							
Sc			c																							
Ozarkodina confluens																										
Pa			r				c			r	r				c		r	c	r	c	r	r		r	r	
Pb			r				r			r							r	r		r	r	r			r	
M			r				r												r							
Sa			r				r										r			r					r	
Sb										r	r					r	r		r							
Sc											r	r													r	
Ozarkodina crispa																										
Pa																	r								r	
Ozarkodina excavata																										
Pa			c				r			r	r	r	r		r		r	r	r						c	
Pb			r				r			r	r			r				r							r	
M			r						r		r				r		r			r					c	
Sa			r				r										r			r					r	
Sb			r							r	r							r					r		c	
Sc			r				r				r						r			r					a	
Panderodus unicostatus																										
simplexiform			r	c	r		r	r		r	c	r	c	r			c	c	c	r	r	c	c	r	a	r
costate	r			c	r	r	r		r	c	r	r	r	r	r	c	c	c	c	c		c	r	c	a	
Walliserodus n.s.p.																										
acodontiform																					r		r	r	c	
costate																									r	

r = rare (1 — 3 specimens) c = common (4 — 10) a = abundant (< 10)

SYSTEMATIC PALAEONTOLOGY

The Yarrangobilly conodonts are described, using multielement taxonomy. In recent years this approach has gained widespread acceptance by conodont workers and can be applied easily to the Yarrangobilly collection. Following the lead of Klapper and Philip (1972), Walliser (1972) and Klapper and Murphy (1975), familial categories are also used. The skeletal element notation that is used to describe representatives of the family Polygnathidae in this paper is described by Sweet and Schönlaub (1975).

All illustrated specimens are stored in the University of Melbourne, Department of Geology Fossil Slide Collection (MUGD.FS). Bulk limestone collections from Yarrangobilly are also stored in the above institution.

Family PANDERODONTIDAE Lindström, 1970

TYPE GENUS: *Panderodus* Ethington, 1959.

REMARKS: The conodonts belonging to this family have been discussed in detail by Lindström (1970), Lindström and Ziegler (1971) and Barnes, Sass and Poplawski (1973).

Genus **Panderodus** Ethington, 1959

Panderodus ETHINGTON, 1959, p. 284.

TYPE SPECIES: *Paltodus unicostatus* Branson and Mehl, 1933.

REMARKS: Multielement *Panderodus* is considered here, according to the interpretation of Cooper (1975, 1976).

Panderodus unicostatus (Branson & Mehl)
(Pl. 17, figs. 9, 11, 13, 14)

Simplexiform element.

Paltodus simplex BRANSON & MEHL, 1953, p. 42, Pl. 3, Fig. 4.

Panderodus simplex (Branson & Mehl). REXROAD & CRAIG, 1971, p. 697, Pl. 81, figs. 35-40; LINK & DRUCE, 1972, p. 75, Pl. 7, figs. 13-16.
Costate elements
Paltodus unicostatus BRANSON & MEHL, 1933, p. 42, Pl. 3, fig. 3.
Panderodus gracilis (Branson & Mehl). REXROAD & CRAIG, 1971, p. 695, Pl. 81, figs. 28, 29; LINK & DRUCE, 1972, p. 72, Pl. 7, figs. 23, 24.
Panderodus unicostatus (Branson & Mehl). REXROAD & CRAIG, 1971, p. 697, Pl. 81, figs. 30-34; LINK & DRUCE, 1972, p. 77, Pl. 7, figs. 19-20, Pl. 11, figs. 13, 15. (Refer Cooper, 1976 for a comprehensive synonymy).

REMARKS: Cooper (1976) has discussed this species, so few details are supplied here. Some specimens of the simplexiform element from Yarrangobilly show the development of a second longitudinal furrow on the inner side just below the first. This feature was also noticed by Lindström and Ziegler (1971) in Devonian representatives of *Panderodus*.

The costate components exhibit great variation in the development of fine ridges adjacent to the longitudinal furrow and along the upper margin. In some costate elements, this ornament is absent altogether. As in other representatives of *Panderodus*, the costate elements form a morphologic series not unlike the symmetry transition series that is found in conodonts having a ramiform element apparatus.

REPOSITORY: Simplexiform elements MUGD.FS 2109-2121; Costate elements MUGD.FS 2122-2128.

Family POLYGNATHIDAE Bassler, 1925

TYPE GENUS: *Polygnathus* Hinde, 1879.

REMARKS: Lindström (1970) and Klapper and Philip (1972) have emended the Polygnathidae with regard to multielement taxonomy.

Representative Silurian genera include *Ancoradella*, *Kockelella* and *Ozarkodina*. *Ancoradella* and *Kockelella* have not been placed in this family by Klapper and Murphy (1975), despite the demonstration of a close relationship between the Pa skeletal element of all three genera as well as the overall apparatus similarity between *Kockelella* and *Ozarkodina* (Walliser, 1964, 1972).

Genus **Ozarkodina** Branson & Mehl, 1933

Ozarkodina BRANSON & MEHL, 1933, p. 51; LINDSTROM, 1970, p. 439-440; KLAPPER & MURPHY, 1975, p. 29 (Refer Klapper & Murphy, 1975 for additional synonymy).

TYPE SPECIES: *Ozarkodina confluens* (Branson & Mehl, 1933) (= *Ozarkodina typica* Branson & Mehl, 1933).

REMARKS: *Ozarkodina* is the best known Silurian multielement conodont genus. Research over the last decade, especially by Walliser (1964) and Helfrich (1975) has demonstrated that several long-ranging and distinct lineages can be recognised within *Ozarkodina*, which could be separated at the subgeneric level by future workers.

Most conservative is the lineage of *Ozarkodina excavata*. In this group, the elements in both P positions may show arching and appear to be ozarkodiniform. The lineage probably extends throughout the Silurian. Representative species include *O. excavata* (Branson & Mehl, 1933), *O. hamata* (Walliser, 1964), *O. posthamata* (Walliser, 1964) and *O. protexcavata* Cooper, 1975.

A second lineage is that of *Ozarkodina confluens*. Species of this group generally have an apparatus containing large, robust skeletal elements with small basal cavities. The lineage is well documented in the Ludlow, but extends back at least into the Llandovery. Representative species include *O. confluens* (Branson & Mehl, 1933), *O. hadra* (Nicoll & Rexroad, 1969) and *O. gulletensis* (Aldridge, 1972).

Helfrich (1975) has recognised an *Ozarkodina sagitta* lineage which includes *O. sagitta*, *O. snajdri* and *O. crispa*, all of Walliser (1964) and *O. bicornutus* and *O. tillmani* of Helfrich. Most skeletal elements in the Pa position of these species are distinguished by partial fusion of the denticles.

Representatives of each of the above lineages are present in the Yarrangobilly collection. A fourth lineage is known from the Upper Silurian and Lower Devonian and is commonly called the *Ozarkodina steinhornensis* group.

Important recent studies of these conodonts are provided by Bultynck (1971), Mashkova (1972) and Fåhraeus (1974). Future research should confirm the presence of additional long-ranging *Ozarkodina* lineages in the Silurian and confirm the close relationship of *Ancoradella* and *Kockelella* to *Ozarkodina*.

Ozarkodina confluens (Branson & Mehl, 1933)
(Pl. 16, figs. 1-7)

Pa element
Spathodus primus BRANSON & MEHL, 1933, p. 46, Pl. 3, figs. 25-30.
Pb element
Ozarkodina typica BRANSON & MEHL, 1933, p. 51, Pl. 3, figs. 43-45.
M element
Prioniodus bicurvatus BRANSON & MEHL, 1933, p. 44, Pl. 3, figs. 9-12.
Sa element
Trichognathus symmetrica BRANSON & MEHL, 1933, p. 50, Pl. 3, figs. 33, 34.
Sb element
Plectospathodus flexuosus BRANSON & MEHL, 1933, p. 47, Pl. 3, figs. 31, 32.
Sc element
Hindeodella confluens BRANSON & MEHL, 1933, p. 45, Pl. 3, figs. 21-23.
Complete Apparatus.
Hindeodella confluens Branson & Mehl, JEPPSSON, 1969, p. 15, figs. 1A-F, 2A-F; JEPPSSON, 1974, p. 31-35, Pl. 5, figs. 1-9D, Pl. 6, figs. 1-3G, Pl. 7, figs. 1-14C, Pl. 8, figs. 1-3.
Ozarkodina confluens (Branson & Mehl). KLAPPER & MURPHY, 1975, p. 30, Pl. 3, figs. 1-23, Pl. 4, figs. 1-27, Pl. 8, figs. 11-15.
(Refer to Jeppsson, 1974 for a comprehensive synonymy).

REMARKS: The skeletal elements of this species are well known, especially as a result of work by Jeppsson (1969, 1974), and Klapper and Murphy (1975). The skeletal element in the Pa position is most variable and Walliser (1964, Text fig. 8) documented the form variation of this element from the *siluricus* Zone to the Lower Devonian. The Yarrangobilly representatives of the Pa components of *Ozarkodina* *confluens* correspond to variants found in the *siluricus, latialata* and *crispa* Zones by Walliser (1964).

Klapper and Murphy (1975) recognise five informal morphotypes of *Ozarkodina confluens* based also on the morphology of the Pa element. Yarrangobilly specimens of the Pa element are identical to the α morphototype of Klapper and Murphy that occurs in strata correlative with the *siluricus, latialata* and *crispa* Zones of Walliser (1964).

REPOSITORY: Pa elements MUGD.FS 2137-2139; Pb element MUGD.FS 2103; M elements MUGD.FS 2095, 2096; Sa element MUGD.FS 2141; Sb element MUGD.FS 2131; Sc elements MUGD.FS 2084, 2085.

Ozarkodina crispa (Walliser, 1964)
(Pl. 16, figs. 16, 17)

Pa element
Spathognathodus crispus WALLISER, 1964, p. 74, Pl. 9, fig. 3, Pl. 21, figs. 7-13; FEIST & SCHÖNLAUB, 1974, Pl. 7, figs. 8, 9, 11, 12, 14, 15; HELFRICH, 1975, Appendix 1, p. 55, Pl. 14, figs. 1-4, 9, 14, 19, 21, 24, 27.
Ozarkodina crispa (Walliser). KLAPPER & MURPHY, 1975, p. 33, Pl. 8, fig. 10.
Complete Apparatus
Multielement Conodont Species, Group X. HELFRICH, 1975, p. 40.

REMARKS: Three specimens conforming to the distinctive Pa skeletal element of this conodont apparatus were identified from Yarrangobilly.

REPOSITORY: Pa element MUGD.FS 2132, 2133.

Ozarkodina excavata (Branson & Mehl, 1933)
(Pl. 16, figs. 8-15)

Pa element
Ozarkodina simplex BRANSON & MEHL, 1933, p. 52, Pl. 3, figs. 46, 57.
Prioniodella inclinata RHODES, 1953, p. 324, Pl. 23, figs. 233-235.
Pb element
Ozarkodina media WALLISER, 1957, p. 40, Pl. 1, figs. 21-25.
M element
Prioniodus excavata BRANSON & MEHL, 1933, p. 45, Pl. 3, figs. 7, 8.
Sa element
Trichognathus excavata BRANSON & MEHL, 1933, p. 51, Pl. 3, figs. 35, 36.
Sb element
Plectospathodus extensus RHODES, 1953, p. 323, Pl. 21, figs. 236-240.
Sc element
Hindeodella equidentata RHODES, 1953, p. 303, Pl. 23, figs. 248, 252-254.
Complete Apparatus
Conodonten-Apparat H WALLISER, 1964, p. 14.
Hindeodella excavata (Branson & Mehl). JEPPSSON, 1969, p. 18, figs. 1G-L, 3A-F; JEPPSSON, 1974, p. 25-31, Pl. 4, figs. 1-17.
Ozarkodina excavata excavata (Branson & Mehl). KLAPPER & MURPHY, 1975, p. 34-37, Pl. 6, figs. 1-20.
(Refer Jeppsson, 1974 for a comprehensive synonymy).

REMARKS: *Ozarkodina excavata* is the most convincing of all Silurian multielement conodont reconstructions. Illustrated specimens from the Yarrangobilly collection include arched, as well as bar-like representatives of the Pa skeletal component.

REPOSITORY: Pa elements MUGD.FS 2134-2136; Pb elements MUGD.FS 2100-2102; M elements MUGD.FS 2097, 2098; Sa element MUGD.FS 2140; Sb element MUGD.FS 2129, 2130; Sc element MUGD.FS 2086, 2087.

Genus **Kockelella** Walliser, 1957
TYPE SPECIES: *Kockelella variabilis* Walliser, 1957.

Kockelella variabilis Walliser, 1957
(Pl. 17, figs. 1-7)

Pa element
Kockelella variabilis WALLISER, 1957, p. 35, Pl. 1, figs. 3-10; WALLISER, 1964, p. 40, Pl. 8, fig. 12, Pl. 16, figs. 1-15.
Complete apparatus
Conodonten-Apparat G. WALLISER, 1964, P. 14 (non Pb element = *Ozarkodina ziegleri ziegleri*).
Kockelella variabilis Walliser. KLAPPER & MURPHY, 1975, p. 53, Pl. 9, figs. 5-11, Pl. 10, figs. 1-16. (Refer Klapper and Murphy, 1975, for a comprehensive synonymy).

REMARKS: The skeletal elements of *Kockelella variabilis* are rare in the author's collections and no M components were recognised. Nevertheless the restricted occurrence of the distinctive Pa element and other apparatus constituents confirm the presence of this multielement species.

REPOSITORY: Pa element MUGD.FS 2089-2090; Pb element MUGD.FS 2099; Sa element MUGD.FS 2094; Sc element MUGD.FS 2091-2092.

Family Uncertain

REMARKS: Under this heading are included conodonts that have a simple-cone skeletal apparatus and cannot yet be placed with confidence in the Family Panderodontidae. Definite familial placement of these genera awaits comprehensive studies of Ordovician ancestors.

Genus **Belodella** Ethington, 1959
Belodella ETHINGTON, 1959, p. 271.

TYPE SPECIES: *Belodus devonicus* Stauffer, 1940.

REMARKS: Cooper (1974, 1976) provides a discussion of this genus.

Belodella anomalis Cooper, 1974
Belodella anomalis COOPER, 1974, p. 1121, Pl. 1, figs. 1-10. Text fig. 1.

REMARKS: This species has, until now, been recorded only from the Yarrangobilly Limestone. A description has been provided elsewhere (Cooper, 1974).

REPOSITORY: MUGD.FS 2075-2083.

Genus **Walliserodus** Serpagli, 1967
Walliserodus SERPAGLI, 1967, p. 104.

TYPE SPECIES: *Acodus curvatus* Branson & Branson, 1947.

REMARKS: *Walliserodus* was revised as a multielement conodont genus by Cooper (1975), and his interpretation is followed in this paper. The two conodont skeletal elements that are described here are sparsely represented in the Yarrangobilly collection, but are referred to *Walliserodus* on the basis of comparison with the type species.

Walliserodus n. sp.
(Pl. 17, figs. 8, 10, 12)

DESCRIPTION: The known skeletal elements of *Walliserodus* n. sp. can best be compared with the acodontiform and one of the asymmetrical costate components in the apparatus of *W. curvatus*.

Acodontiform Element

This is a simple uniformly curved biconvex cone, almost symmetrical in cross-section. The upper and lower margins are generally sharp, but the lower margin is flattened towards the base. A deep basal cavity that constricts to a tip near the lower margin is present. The lateral sides are smooth except for fine striations slightly oblique to the length of the unit.

Costate Element

This is a gently curved paltodontiform element. On one side, near the lower margin, a strong costa is apparent that extends almost the full length of the element. Around the upper margin, a series of longitudinal costae of varying length occur, most obvious about the mid-length. A narrow, sharply defined, wrinkled zone is present around the basal margin.

REMARKS: The acodontiform element of *Walliserodus* n. sp. differs from its counterpart in *W. curvatus* in the lack of a lateral costa. The costate component can be best compared in *W. curvatus* with the costate element previously described as the form-species *Paltodus debolti* by Rexroad (1967). However in *W. curvatus*, this element has lateral costae near the lower margin on both sides of the unit.

REPOSITORY: Acodontiform elements MUGD.FS 2105-2107; Costate element, MUGD.FS 2108.

ACKNOWLEDGEMENTS

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APPENDIX

LOCALITY REGISTER

All Grid. References (G. R.) refer to the Yarrangobilly (1 inch = 1 mile) map sheet.

MEASURED SECTION 1: Yarrangobilly Caves. Tops of Section G. R. 29941806, Base of Section G. R. 29981808.

This section misses the youngest horizons of the Yarrangobilly Limestone because of rapid lensing of the formation, south of Caves House. The youngest beds of the Yarrangobilly Limestone were collected in the caves area along the Thermal Pool Path. This is illustrated by the addition shown at the top of the first column in Fig. 2.

MEASURED SECTION 2: Yarrangobilly Village. Top of Section G. R. 29811859, Base of Section G. R. 29841859.

The main belt of limestone, just east of Yarrangobilly Village has split into two parts. This measured section is across the westernmost limestone band only. Isolated samples Y45 and Y49 can be accurately fixed on this section.

ISOLATED SAMPLES: Y30, Y31, Y32, Y33, Y34, samples collected progressively down Thermal Pool Path (G. R. 29931807); Y45 (G. R. 29811858); Y46 (G. R. 29911846); Y47 (G. R. 29911848); Y48 (G. R. 29891849); Y49 (G. R. 29821854); Y50 (G. R. 29961813).

EXPLANATION OF PLATES 16 & 17

All specimens in Plates 16 and 17 (which follow) were photographed, using a Graflex camera having a SM3-CS1 attachment on a J.E.O.L. Scanning Electron Microscope.

PLATE 16

Figs. 1-7—*Ozarkodina confluens* (Branson & Mehl). (1) Lateral view of Pa element, MUGD.FS 2138, ×60, Y49. (2) Basal view of Pa element, MUGD.FS 2138, ×60, Y49. (3) Lateral view of M element MUGD.FS 2095. ×120, Y19. (4) Lateral view of Pb element MUGD.FS 2103, ×60, Y49. (5) Posterior view of Sa element, MUGD.FS 2141, ×60, Y41. (6) Lateral view of Sc element, MUGD.FS 2084, ×60, Y49. (7) Lateral view of Sb element, MUGD.FS 2131, ×60, Y49.

Figs. 8-15—*Ozarkodina excavata* (Branson & Mehl). (8) Lateral view of Pb element, MUGD.FS 2101, ×60, Y49. (9) Lateral view of Pa element with prominent apical denticle, MUGD.FS 2136, ×60, Y31. (10) Lateral view of Pa element showing arching, MUGD.FS 2135, ×40, Y7. (11) Lateral view of Pa element, MUGD.FS 2134, ×60, Y49. (12) Lateral view of Sb element, MUGD.FS 2129, ×60, Y49. (13) Posterior view of Sa element, MUGD.FS 2140, ×120, Y49. (14) Lateral view of Sc element MUGD.FS 2087, ×60, Y49. (15) Lateral view of M element, MUGD.FS 2097, ×60, Y49.

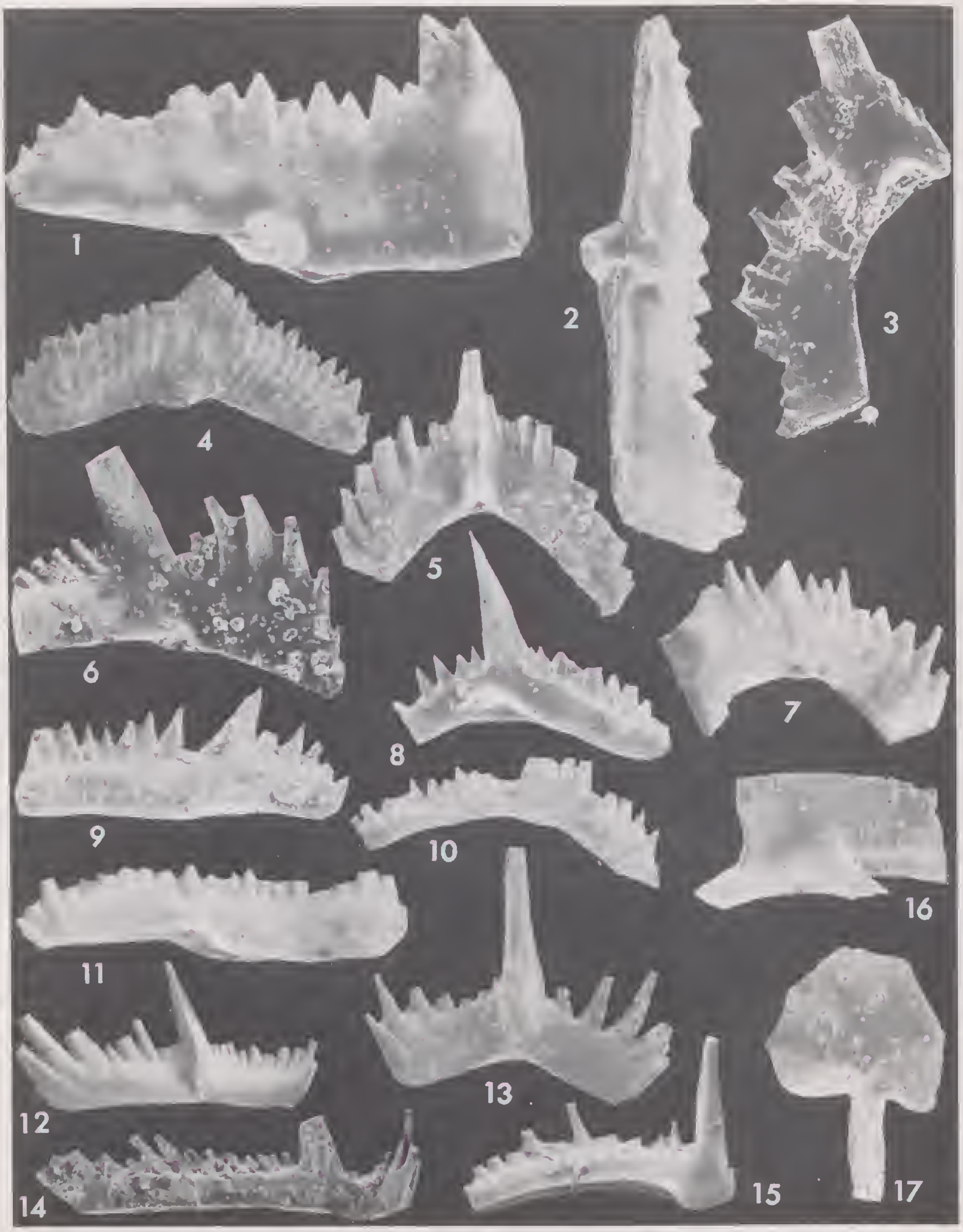
Figs. 16, 17—*Ozarkodina crispa* (Walliser). (16) Lateral view of Pa element, MUGD.FS 2132, ×100, Y49. (17) Basal view of Pa element, MUGD.FS 2132, ×100, Y49.

PLATE 17

Figs. 1-7—*Kockelella variabilis* (Walliser). (1) Basal view of Pa element, MUGD.FS 2089, ×60, Y7. (2) Lateral view of Pa element, MUGD.FS 2090, ×100, Y7. (3) Posterior view of Sa element, MUGD.FS 2094, ×100, Y7. (4) Lateral view of Sc element, MUGD.FS 2091, ×60, Y7. (5) Top view of Pa element, MUGD.FS 2089, ×60, Y7. (6) Lateral view of Sb element, MUGD.FS 2104, ×100, Y6. (7) Lateral view of Pb element, MUGD.FS 2099, ×100, Y7.

Figs. 8, 10, 12—*Walliserodus* n. sp. (8) Lateral view of possible costate element MUGD.FS 2108, ×200, Y49. (10) Other lateral view of costate element, MUGD.FS 2108, ×200, Y49. (12) Lateral view of possible acodontiform element, MUGD.FS 2105, ×200, Y49.

Figs. 9, 11, 13, 14—*Panderodus unicostatus* (Branson & Mehl). (9) Outer lateral view of costate element, ×60, Y49. (11) Inner lateral view of costate element, MUGD.FS 2112, ×60, Y49. (13) Inner lateral view of simplexiform element MUGD.FS 2122, ×60, Y49. (14) Inner lateral view of costate element, MUGD.FS 2111, ×400. Y49.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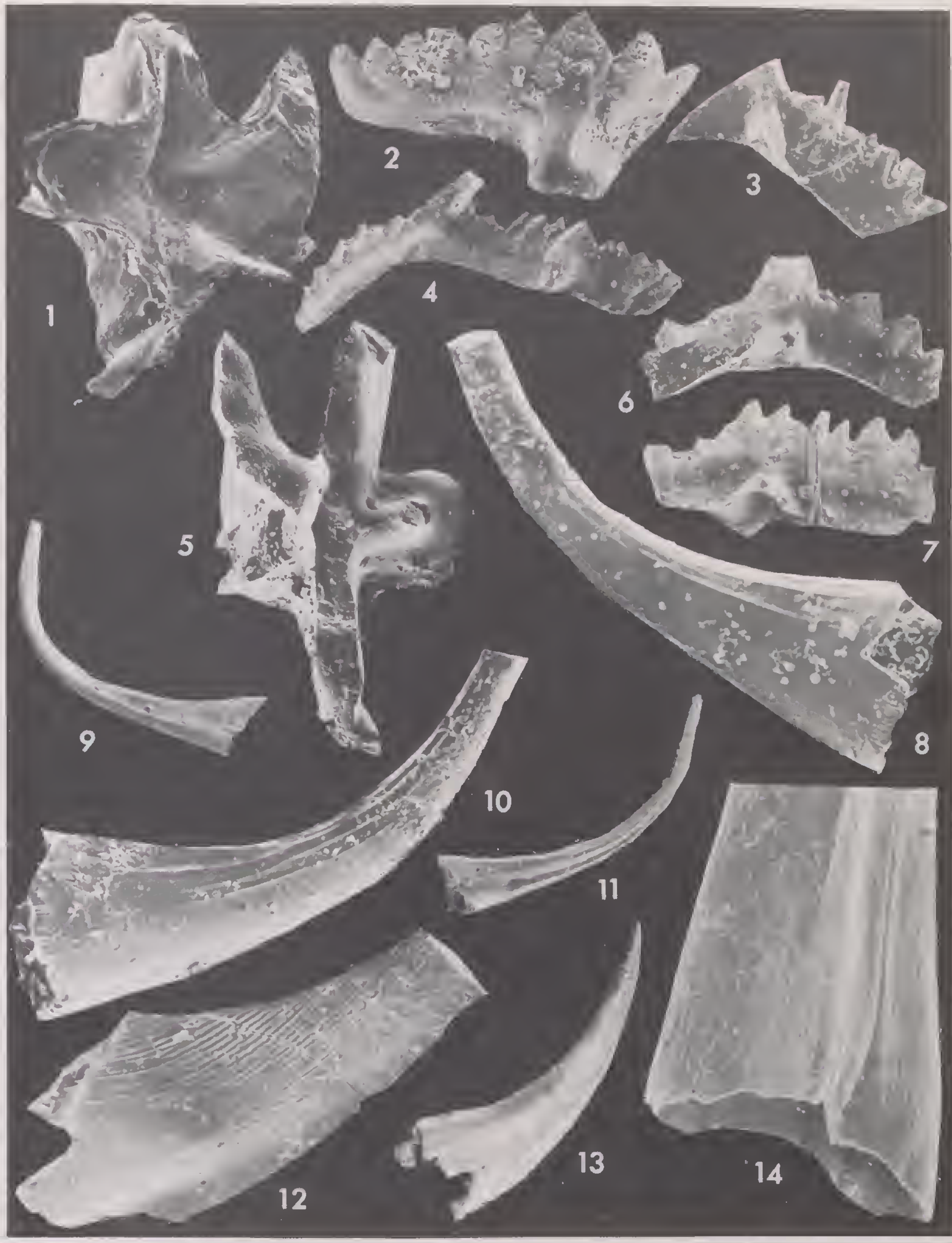
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